

WHAT IS CLAIMED IS:

1 1. A method of preparing for incremental printing of a
2 color image; said method comprising:
3 receiving or generating data representing a device-
4 color implementation of the image, including respective
5 initial representations of at least black ink and chroma-
6 tic-color inks; and
7 applying a substantially direct transform to:

8
9 modify quantity of black ink represented in
10 the data, and

11
12 recombine the modified quantity of black
13 ink with the initial representations.

1 2. The method of claim 1, wherein the applying step
2 comprises automatic modification of:
3 black ink represented in the data, in highlight and
4 midtone regions of the image.

1 3. The method of claim 1, wherein the applying step
2 comprises automatic modification of:
3 black ink represented in the data, primarily in
4 highlight and midtone regions of the image, to mitigate
5 graininess in those regions; and
6 black ink represented in the data, in darker regions
7 of the image, to smoothly blend black-ink quantities
8 in the darker regions with the modified black-ink quantities
9 in the highlight and midtone regions.

1 4. The method of claim 3, wherein the automatic modifi-
2 cation of black comprises establishing:
3 a black-ink onset point; and
4 an increasing function of said initial representation
5 of black ink, in regions of an image darker than the onset
6 point.

1 5. The method of claim 4, wherein the automatic modifi-
2 cation of black further comprises:
3 merging said function into substantially a black-
4 identity function in darkest regions of an image.

1 6. The method of claim 3, wherein the applying step
2 further comprises automatic modification of:
3 chromatic-color inks to accommodate the black-ink
4 modifications.

1 7. The method of claim 6, wherein:
2 the applying step comprises automatically recombining
3 the modified quantity of black in a way that is inversely
4 proportional to the initial representations of at least
5 the chromatic-color inks.

1 8. The method of claim 7, wherein:
2 the automatically recombining comprises finding in a
3 lookup table new quantities of said representations, cor-
4 responding to said quantified black-modifying.

1 9. The method of claim 7, wherein:

2 final ink representations C' , M' , Y' and K' for cyan,
3 magenta, yellow and black respectively are found from the
4 expressions:

5
6
$$C' = C + (1 - C) \cdot A_C(K)$$

7
$$M' = M + (1 - M) \cdot A_M(K)$$

8
$$Y' = Y + (1 - Y) \cdot A_Y(K)$$

9
$$K' = A_K(K),$$

10

11 where C , M , Y and K are the initial representations of the
12 same colors respectively, and A_C , A_M , A_Y and A_K are respec-
13 tive preestablished automatic black-replacement functions.

1 10. The method of claim 2, wherein:

2 the direct transform application comprises finding in
3 a lookup table new quantities of said representations,
4 corresponding to said quantified black-modifying.

1 11. The method of claim 1, further comprising the step
2 of:

3 splitting at least one of the final ink representa-
4 tions to implement the at least one representation in
5 available light and dark colorants.

1 12. The method of claim 1, wherein:

2 color initially having no black-ink component is
3 passed through without modification.

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1 13. The method of claim 1, further comprising the step
2 of:
3 applying the data with recombined black ink in print-
4 masking for hardcopy printing.

1 14. The method of claim 1, further comprising the steps
2 of:
3 a human operator's manipulation of a control that se-
4 lects an amount and a direction of black-ink modification;
5 and
6 thereafter, substantially automatic operation of said
7 direct transform to effectuate the modifying and recombining parts of the applying step according to the operator's
8 selection.
9

1 15. An incremental printing system for forming an image
2 by construction from dots deposited on a printing medium,
3 based upon original image data in device-color space; said
4 system comprising:
5 a direct device-color to device-color substantially
6 automatic computation module for modifying color image
7 data with no manipulation in terms of perceptual color
8 parameters; and
9 an output incremental printing stage for printing the
10 image from the modified data.

1 16. The system of claim 15, wherein the automatic module
2 comprises:

3 an input for receiving such original image data in
4 the form of initial four-or-more-color separations; and
5 an output for directing four-or-more-color separa-
6 tions to the output stage.

1 17. The system of claim 15, wherein the automatic module
2 comprises a computation submodule for establishing:

3 a black-ink onset point; and
4 an increasing function of an initial amount of black
5 ink, in regions of an image darker than the onset point.

1 18. The system of claim 17, wherein the automatic module
2 further comprises:

3 a computation submodule for merging said function
4 into substantially a black-identity function in darkest
5 regions of an image.

1 19. An incremental printing method for forming an image
2 by construction from dots deposited on a printing medium,
3 based upon original image data in device-color space; said
4 method comprising the steps of:

5 a direct device-color to device-color substantially
6 automatic computation to modify color image data with no
7 manipulation in terms of perceptual color parameters; and
8 then incrementally printing a hardcopy image from the
9 modified data.

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1 20. An incremental-printing image-preparation method, for
2 accommodating personnel who are accustomed to thinking in
3 terms of ink combinations rather than in terms of numeri-
4 cal perceptual color models; said image to be printed
5 based upon an original image data file that substantially
6 expressly represents inking to be used; said method com-
7 prising the steps of:

8 receiving from said personnel an indication of quan-
9 tity of black ink and other inks desired, in the form of
10 at least four color separations, for use in incremental
11 printing; and

12 in preparing for incremental printing, directly and
13 automatically implementing changes in represented quantity
14 of black ink, for colors that initially have black ink.

1 21. The method of claim 20, wherein:

2 the change-implementing step comprises automatic re-
3 duction of black ink represented in the data, primarily in
4 highlight and midtone regions of the image, to mitigate
5 graininess in those regions.

1 22. An incremental-printing image-preparation method, for
2 accommodating personnel who are accustomed to thinking in
3 terms of ink combinations rather than in terms of numeri-
4 cal perceptual color models; said image to be printed
5 based upon an original image data file that substantially
6 expressly represents inking to be used; said method com-
7 prising the steps of:

8 receiving from said personnel an indication of change
9 in quantity of black ink desired, in incremental printing;
10 and

11 directly implementing the indicated change, in pre-
12 paring for incremental printing.

1 23. The method of claim 22, wherein:

2 the indication is substantially without reference to
3 any perceptual color model.

1 24. The method of claim 22:

2 wherein the implementing step comprises automatic
3 adjustment in quantities of chromatic inks, compensating
4 for the indicated change in quantity of black ink;

5 wherein said compensating comprises substantially
6 maintaining tonal values in areas of ink change; and

7 further comprising the step of applying the data file
8 with the implemented change, to printmasking for hardcopy
9 printing.

- 1 25. An incremental printing system for forming an image
2 by construction from dots deposited on a printing medium,
3 based upon original image data in device-color space, un-
4 der control of a user; said system comprising:
5 a direct device-color to device-color graphical com-
6 puter interface module for enabling the user to modify
7 color image data in preparation for printing, without re-
8 quiring the user to directly manipulate perceptual color
9 parameters; and
10 an output incremental printing stage for printing the
11 image from the modified data.
- 1 26. The system of claim 25, wherein the interface com-
2 prises controls enabling the user to set substantially
3 directly:
4 a black-onset point; and
5 an increasing function of an initial amount of black
6 ink, for black-containing colors darker than the black-
7 onset point.
- 1 27. The system of claim 26, wherein:
2 the interface further comprises controls enabling the
3 user to substantially directly set merging of said func-
4 tion with a black-identity function in darkest regions of
5 the image.